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Program objectives were to develop children's abilities to deal with everyday and school related problems, and to make them more inner-directed by (1) developing a positive self-image, (2) increasing sensory and perceptual acuity, (3) improving language skills, and (4) improving problem-solving and concept formation abilities. Forty-five environmentally deprived 3- and 4-year-old children attended the New Nursery School: 30 were either Spanish- or Mexican-American. The school was organized as an autotelic responsive environment. Each child explored activities freely, proceeding at his own rate to discover relationships. The learner was informed about the consequences of his actions by self-correcting toys, machines, other children, or the teacher. Pre- and posttests were administered to measure intelligence (PPVT and Stanford-Binet), but no firm conclusions about I.Q. were drawn. Other tests given were the Pre-School Inventory, Cincinnati Autonomy Test Battery (six tests), an articulation test, two tests on concept formation, and a test of color identification. On the whole, an experimental group of middle class children scored somewhat higher on the tests than the deprived children. Older children also had higher scores than younger children, indicating a pattern of orderly increase with age and nursery school experience. (DR)

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PROGRESS REPORT ON RESEARCH AT THE NEW NURSERY SCHOOL

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PROGRESS REPORT ON RESEARCH AT THE NEW NURSERY SCHOOL
GENERAL BACKGROUND AND PROGRAM RATIONALE

Introduction

The particular concern at the New Nursery School is for forty-five, three and four year old environmentally deprived Spanish-surnamed children.[1] In addition to environmental deprivation, these children have a different culture and language. We believe that if we can demonstrate the effectiveness of a carefully designed nursery school program with these children, a similar program will benefit other environmentally deprived children. Our criteria for selection of the children were:

1. All forty-five children must be from impoverished homes, i.e., on welfare rolls, no steady wage earner in the home, low educational achievement of the parent, living in sub-standard housing, a history of anti-social behavior in the family, and a history of poor school achievement of older siblings. Not all conditions must be present in the background of every child, but a combination of three or more must be present in the background of each child.

2. Thirty children must be Spanish surnamed.
   a. Ten, three years old with no previous nursery school experience
   b. Ten, four years old with no previous nursery school experience
   c. Ten, four years old with one year of previous nursery experience at the New Nursery School

3. Fifteen children must be environmentally deprived, but not Spanish surnamed.
   a. Eight, four years old
   b. Seven, three years old

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[1] In the main, these children are Spanish and Indian. The designation Spanish-American or Mexican-American is used interchangeably by the general population, but the individuals involved make distinctions according to their family's origin. Some families came from Spain, settled in the Southwest when it was still under Mexican rule, and intermarried with the Indians; others settled in Mexico, and then moved to the United States. Regardless of origin, some individuals prefer to be called "Spanish-American" and some prefer "Mexican-American." To avoid offending any of these people and to simplify writing, we refer to them all as Spanish-surnamed.

The Facilities

The New Nursery School is located in a house near neighborhoods where most of the children live. We chose the house because we wanted a noninstitutional setting within walking distance of as many of the children as possible. The house is near a public school so many of the children come and go with older brothers and sisters. The house is adequate for our need and we apparently have been accepted by the parents. Even though the school is unoccupied from 4:30 p.m. to 8:30 a.m., we have not suffered from any serious acts of vandalism nor has any equipment been taken from the yard.

The instructional space in the school consists of an "L" shaped room and two responsive environment booths that are approximately seven feet by seven feet. The "L" shaped room contains an art area, a dress-up area, a block corner, a reading corner, a listening corner, a manipulative toy area and a concept formation area. The reading, listening, aand manipulative toy areas are clustered in the smaller part of the "L", the noisier activities are in the other part of the room. Cubicles for each child's coat and boots are located on an enclosed porch adjacent to the main room. In addition to the instructional space, the New Nursery School has a bathroom, an office, a conference room (in the basement) and observation areas looking in on the main classroom and each responsive environment booth. The observation areas allow us to record anything that takes place in the learning areas and make the school a demonstration and behavioral science research center as well as a learning center.

The Objectives

The overall objective of the program is to facilitate the development of the kind of coping behavior which is exigent for efficient

dealing with everyday problems and more particularly, with school related tasks. This attempt to augment the children's rational, problem-solving approach to life is consistent with Harvey's cogent description of a concreteness-abstractness continuum (1961). We are seeking to enable the children to become "System 4" individuals:

> System 4 functioning, the more abstract end of the continuum, is viewed as the consequence of childhood freedom to explore both the social and physical aspects of one's environment, to establish and rely upon values derived from one's own experience and thought, and for deviating from established truth. The System 4 representative who is the recipient of diversity along with stability as a developing child, and who is of high perceived self-worth despite momentary frustrations and deviation from the normative, comes to have a highly differentiated and intergrated cognitive structure and consequently to more flexible, more creative and more relative in thought and action. More than persons of any other systems, the System 4 individual has a set of internal standards that are more truly independent of external criteria, in some cases coinciding with social definitions and in other not (Harvey, 1966, pp 45-46).

This overall objective to increase the probability of each individuals's becoming inner-directed (Reissman, 1962) is approached by zeroing in on four more specific operational objectives:

1. To develop a positive self-image;
2. To increase sensory and perceptual acuity;
3. To improve language skills;
4. To improve problem-solving and concept formation abilities.

These four specific objectives closely parallel Deutsch's objectives at the Institute of Developmental Studies at New York University. We chose these four objectives because the studies and research indicated that environmentally deprived children had not developed in these areas to the extent that one would expect from observation of other children. This lack of development logically, seems to be related to their environment and to the ultimate failure to accomplish our overall objectives.

The Approach

The entire school is organized as an autotelic responsive environment as Moore has defined it. The reader who is familiar with nursery school education will note that many outstanding nursery school programs in the United States have been operated more or less as responsive environments without saying so, but we believe it is essential to state these principles explicitly because of their importance in formulating curricula and procedures and in evaluating the results. Moore and his colleague, Anderson, have defined an activity as autotelic if the activity is done for its own sake rather than for obtaining rewards or avoiding punishment that have no inherent connection with the activity itself.

Moore has defined a responsive environment as one which satisfies the following conditions:

1. It permits the learner to explore freely;
2. It informs the learner immediately about the consequences of his actions;
3. It is self-pacing, i.e., events happen within the environment at a rate determined by the learner;
4. It permits the learner to make full use of his capacity for discovering relations of various kinds;
5. Its structure is such that the learner is likely to make a series of interconnected discoveries about the physical, cultural or social world (Moore, 1963, p.2).

In a responsive environment, the child is not taught something, but he learns many things. The objective is not to teach the child something step by step but to place him in a situation where he can make meaningful discoveries. It is a constant and all-pervasive challenge to the staff to create the kinds of encounters which are characterised by optimal discrepancy (Harvey, 1966, pp 63-64) and are therefore maximally effective for producing open, expanded, articulated and integrated cognitive systems necessary to cope with the rapidly changing

environment. In our judgment, this aspect of the responsive environment is more important than the fact that a child may learn to read and write. This is, of course, speculative at this time and we have no hard data to support or deny our contention. Nevertheless, there is considerable evidence in the current literature (e.g. Bruner, 1960; Shulman and Keislar, 1966) which supports the notion that this approach to learning is particularly efficacious.

By insisting that all activities are *autotelic* and avoiding unrelated rewards or punishments we create a situation where we know the child is doing something because he wants to and not because an adult is applying pressure to have the child accomplish some task that the adult has decided the child is ready to do. This means that in observing the child's behavior in the classroom, we can assume we are seeing the child make choices and carry out certain activities that are not pressed upon him by an adult. Thus, we can study curriculum development, the relationship between maturation and learning and hierarchies of low and high probability behaviors (Homme, 1963; Premack, 1959) without fear of pushing the child beyond his capacity.

The notion of a *responsive environment* is equally important. We control what the child will do by the choices we make about what to include in or exclude from the learning environment. Once the child enters the classroom he is free to explore. He can spend as much time on any activity as he likes; no one will ask him to stop one activity to begin another. This has some interesting consequences. For example, the concept of attention span must be modified. These children do have a short attention span if they are required to do what the adult wants to do when the adult wants to do it. But when the children are allowed to choose their own activities this no longer holds. Many children

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have been read to for an hour and a half. One child painted 25 pictures without stopping. Another spent the whole three hours, except for time out for refreshments, playing a game which required him to recognize and match pictures. Some children will spend over half of their time, particularly at the beginning of the year, playing with the blocks. But as the year progresses, their activities become more varied and they spend some time in the reading corner, the listening corner or the manipulative toy area. We have group activities such as singing and story telling, but no child is required to take part. At the beginning of the year several (five or six of fifteen) will choose not to come to the group, but day by day they scoot closer until they have also joined in the activities. After that it is a rare occasion when a child chooses not to come.

The notion that the environment informs the learner immediately about the consequences of his actions determines the kind of equipment that is used, they way it is used, and the behavior of the teacher and her assistants. The learner is informed either by the self-correcting toys, machines, other children, or the teacher. Most of the manipulative toys are self-correcting. The nesting and stacking toys go together or stack in only one way; the puzzles are the same. Concentric circles, squares, or rectangles must fit inside each other to complete the pattern, and so forth. The Bell and Howell Language Master is an example of a machine that tells the child about the consequences of his actions. The Language Master records and plays back sound recordings on two channels on magnetic tape located across the bottom of cards that vary in size from 8 1/2" by 11" down to 3" by 6". One can write or draw on the card so that a child sees and hears something at the same time. The child can operate the machine without assistance, and

he is free to play with it. For example, on a card, "This color is red." The child then has a means of verifying his notions by operating this responsive device.

The application of the concept of an autotelic responsive environment concept to the organization and methods of teaching in a nursery school classroom has many worthwhile effects. The child is free to spend as much time playing with the colors as he wants or if he wants to know the name of a specific color he can go and find out -- the machine will give him the necessary feedback. We have also installed a modified juke box for a simple random-access information retrieval system by which children can have books read to them, songs sung to them or receive other auditory input.

The teacher and her assistants are another source for the child to use in finding out the consequences of his acts. The important thing for the teacher and assistants to remember is that they are a part of a responsive environment and respond to the child as he spontaneously encounters and manipulates his surroundings -- <u>they do not teach; they facilitate children's learning</u>. This statement will become evident as we elaborate upon the specific approaches we use to obtain the objectives of the school. In general we do the following:

1. Discourage adult initiated conversation but encourage child initiated conversation;
2. Never ask a child if he wants to be read to but always read to him when he asks to be read to;
3. Avoid asking a child to give up one activity to do something else; and
4. Never insist that any children come to a group activity.

Most of a child's three hours in school is spent in self-directed activities such as painting, working puzzles, looking at books, dressing up, building with blocks, and a host of other activities. About fifteen minutes a day are devoted to group activities such as singing, listening,

to a story, or participating in a planned lesson. If a visitor were to walk into the school as the children are arriving in the morning, he could expect to see one or two children go immediately to paint or play with clay, three or four children settle down in the block corner, two or three children head for the listening corner to listen to a record that they select on a remote control juke box or to play with the Language Master, three or four children select a manipulative toy, the alphabet board, or a wood insert puzzle to play with, one child asks to be read to and one or two children ask to go type. At mid-morning several of the children will still be at the same activity. Others, perhaps five or six, will be gathered around the teacher playing a game with colors or simple concepts, some child will be joining the group while others are going to another activity, when the children have lost interest the teacher will introduce a new game or go to another game. Late in the morning or afternoon the visitor will find most of the children outside, one or two might still be in the room with a teaching assistant, and one might be in the typing booth.

Once each school day a booth assistant asks a child if he would like to play with the typewriter. If he says "yes", the assistant takes him to one of two booths equipped with an electric typewriter. The child is allowed to play with the typewriter for as long as twenty minutes. The child begins in the booth by simply playing with the typewriter. The assistant answers his questions and names the symbols he strikes, such as, "x", "a", "y", "comma", "space", and "return". The child will move from this first phase to finding and striking a letter that is shown to him. The child will move on to typing words and eventually to dictating stories to the booth assistant who transcribes the stories. Finally, he will transcribe his own stories.

Moore has had extremely good success in enabling three and four-year-old children to learn to read using such procedures; but, like Moore, we are not so concerned about the children's learning to read at an early age as with the mental process involved in discovering such relationships as the association of sounds with symbols and the discovery of the rules for a new game as we move from one phase to another. Obviously, if the child can see a form such as A on a piece of paper find the same form on the keyboard of a typewriter and hear a booth assistant say "A", we are accomplishing one of our aims, that of helping the child to perceive different forms and discriminate among sounds.

In other publications we have developed, in detail, the reasons why we have organized the school as a responsive environment, the reason for selecting our objectives, and the specific learning episodes we use.

TESTING DESCRIPTION AND RESULTS

Evaluation

In order to evaluate the effectiveness of the New Nursery School program we have used conventional tests such as the *Peabody Picture Vocabulary Test* and the *Stanford-Binet Test of Intelligence*. Both of these tests purport to measure intelligence, which is assumed to be a fairly stable measure of an individual's intellectual or cognitive ability, but we are using these tests not only as valid predictors of school success but as measures of the effectiveness of our nursery school program. Previous research (California paper) indicates that an intelligence test score is fairly reliable for middle-class children and for environmentally deprived (E D) children who score average or above but not for lower class children who score below average. Therefore,

we expected some changes in scores for E D children who scored below 90 on the initial test.

We have also experimented with the *Pre-School Inventory* and with the *Cincinnati Autonomy Test Battery*. In addition we administered an articulation test, two tests on concept formation and a test of color identification.

In analyzing the data we used a pre-test - post-test design and made comparisons between groups when pre-test - post-test data were not available. Our population consists of three sub-groups of New Nursery School children (NNS's), (1) three-year-old environmentally deprived children who are attending the school for the first time (NNS-3), (2) four-year-old environmentally deprived children who are attending the school for the first time (NNS 4-1) and (3) four-year-old environmentally deprived children who are attending the school for the second year (NNS 4-2), plus an experimental group of middle-class children who attend the REN school, which has the same objectives and procedures. The REN children are sub-divided into comparable groups (REN 3, REN 4-1, REN 4-2).

All of the NNS children attended school three hours a day, five days a week for a school year. The attendance of REN children varied from two to three days a week over the same period of time.

The *Stanford-Binet* (SB) and the *Peabody Picture Vocabulary Test* (PPVT) were both administered in September of 1966, and the PPVT (form B) was administered in May, 1967. The Stanford-Binet will not be given until September, 1967. At that time we will also test a control group of environmentally deprived children who have not had experience at the New Nursery School (some will have attended a summer Head Start program) and establish the base for a longitudinal study.

Results on Stanford-Binet and Peabody Picture Vocabulary Test

Table I shows the results on the S-B and the PPVT administered at the beginning of the school year in September, 1966. Since the NNS 4-2 and REN 4-2 are attending the schools for the second year, these tests are the second or, in a sense, the post-test scores for these children. Their pre-test scores in September, 1965 are shown in Table II.

The rank order correlation between the S-B I.Q. scores and PPVT I.Q. scores for the NNS data was .67 and for the REN data it was .41.

TABLE I

Mean I.Q. scores on the Stanford-Binet and the Peabody Picture Vocabulary Test for NNS and REN children administered in September, 1966.

	S-B			PPVT		
GROUP	N	M I.Q.	SD	N	M I.Q.	SD
NNS 3	14*	90.57	15.0	16	77.75	20.68
NNS 4-1	20	82.30	12.80	20	68.65	18.75
NNS 4-2	7	95.14	5.14	7	92.85	18.00
REN 3	5**	115.40	13.0	6	112.67	16.50
REN 4-1	10***	113.20	15.40	12	119.66	15.75
REN 4-2	3	113.66	20.67	3	113.00	8.66

*Two children scored so low on the S-B the tester could not establish a basal score.
**One child refused to be tested
*** One child refused to be tested and no basal was established for another child

TABLE II

The pre-test I.Q. test scores on the Stanford-Binet and Peabody Picture Vocabulary test for the NNS 4-2 and REN 4-2 children.

GROUP	N	S-B M I.Q.	SD	N	PPVT M I.Q.	SD
NNS 4-2	7	99	5.57	5	92.60	4.20
REN 4-2	3	116	18.67	3	94.67	20.33

Table III shows the relationship of the pre-and-post-test PPVT I.Q. scores of two experimental groups.

TABLE III

The Pre-and-Post-test I.Q. Score means, standard deviations, and mean differences on the PPVT for the NNS and REN children (1966-67)

Group	N	Pre-Test M	Pre-Test S-D	Post-Test M	Post-Test S-D	Mean Difference
NNS 3	15	75.10	20.33	78.10	15.87	3.00
NNS 4-1	12	73.24	22.50	81.13	15.58	7.89
NNS 4-2	5	92.20*	5.40	100.10	3.06	7.90
REN 3	5	117.20	14.80	125.00	5.80	7.80
REN 4-1	10	120.50	16.90	114.60	11.50	-5.90
REN 4-2	5	95.40*	27.00	111.40	22.40	16.00

* Pre-tests were given in September 1965 thus reporting differences over two years. Others are over one year.

Previous research indicates that greater changes in test scores should occur with the ED children who scored below 90. Table IV shows the changes in mean scores for the NNS children grouped according to their pre-test scores.

Table IV

The mean scores on the pre- and post-test PPVT scores for NNS children grouped according to pre-test scores.

Group	I.Q. Group	N	Test adm. Sept., 1965	Test adm. Sept., 1966	Test adm. May, 1967	Mean Change
		5	non-testable (no base)	?		?
NNS-3 and NNS 4-1 (over 1 year)	I.Q. below 80	17		61.05	73.41	+12.36
	I.Q. 80-89	2		86.50	80.50	-6.00
	I.Q. 90 above	8		100.62	92.50	-8.12
NNS 4-2 (over 2 years)	I.Q. below 80	0				
	I.Q. 80-89	1	82.00		101.00	+19.00
	I.Q. 90 above	4	94.75		101.75	+7.00

Analysis of Results on the Stanford Binet and the PPVT

Throughout most of this report our analysis is limited to looking for trends and patterns, because when we group the children according to age groups and the number of years in school the number in each group is so small that statements of statistical significance can be misleading.

For the NNS children the mean I.Q. score on the PPVT increased 5.6 points from the pre-test to post-test and the change for REN children was 3 points. At the same time the variability (standard

deviations) decreased and thus the change is probably due to a regression towards the mean rather than any real improvement in test scores. Although all the mean differences except for REN 4-1 were positive from pre-to post-test, the standard error of the mean could in each case account for the differences. This becomes more evident when we examine Table IV which shows the decreases in scores for the children who scored higher on the test in the first place. However, the mean increase of 12.36 for the 17 children who scored below 80 on the pre-test is consistent with our prediction that this group is the one wherein the greatest changes could be expected. Durkin's book, Children Who Read Early, (1966) corroborates this finding that children with lower I.Q.'s seem to profit more from early reading instruction than do the more able. Because we did have children whom we could not test on the pre-test but could test on the post-test the actual changes for the low group are probably considerably greater than the table shows.

In any event, the major purpose of administering the Stanford-Binet and Peabody Picture Vocabulary Tests was to establish baseline data for the longitudinal study and it is too early in the study to draw any firm conclusions about the changes in I.Q. test scores.

The Pre-School Inventory

The Pre-School Inventory by Betty M. Caldwell and Donald Soule (memo. Children's Center, Dept. of Pediatrics Upstate Medical Center, State University of New York, Syracuse, New York, no date) is still in the developmental stage and our use of the test was designed to evaluate the test as well as our program. The authors gave the following description of the pre-school inventory.

> The Preschool Inventory is a brief assessment procedure designed for individual use with children in the three-to-six age range. It was developed to give a measure of achievement in areas regarded as necessary for success in school. It is by no means culture free; in fact one aim of the instrument is to permit educators to highlight the degree of disadvantage which a child from a deprived background has at the time of entering school in order to help eliminate any observed deficits. Another goal in the development of the procedure was to make available an instrument that was sensitive to experience and could thus be used to demonstrate changes associated with educational intervention. (p.1).

The norms are currently based upon 171 children who attended a Head Start program during the summer of 1965. Through a process of factor analysis, the authors identified four factors: (1) Personal-Social Responsiveness - Factor A; (2) Associative Vocabulary - Factor B; (3) Concept Activation, Numerical - Factor C; and (4) Concept Activation, Sensory - Factor C_2. The following is a brief description of each factors composition:

> Factor A. Personal-Social Responsiveness. This factor appears to involve knowledge about the child's own personal world (name, address, parts of body, friends) and his ability to establish rapport with and respond to the communications of another person (carrying out simple and complicated verbal instructions given by an adult). Perhaps more than any other factor, it represents the type of eminently practical ability which the Inventory was originally designed to assess.
>
> Factor B. Associative Vocabulary. This factor requires the ability to demonstrate awareness of action or by associating to certain intrinsic qualities of the underlying verbal concept. Item units having high loadings include simple labeling of geometric figures, supplying verbal or gestural labels for certain functions, actions, events and time sequences, and being able to describe verbally the essential characteristics of certain social roles. Many of the specific deficits frequently attributed to culturally deprived children cluster in this factor.

Factor C. Concept Activation. This is the factor that accounted for the greatest amount of common variance. The concepts involved seem to represent two major categories: ordinal or numerical relations, and sensory attributes such as form, color, size, shape, and motion. The activation involves either being able to call on established concepts to describe or compare attributes (relating shapes to objects, color-names to objects or events) or to execute motorically some kind of spatial concept (reproduction of geometric designs or drawing the human figure). High scores on this factor involve being able to label quantities ("How many" questions), to make judgments of more or less, to recognize seriated positions (first, last, middle), to be aware of certain sensory attributes (shape, size, motion, color), and to be able to execute certain visual-motor configurations (geometric forms, draw - man).

As this factor accounted for the greatest amount of common variance on the initial version of the instrument, and as it appeared to be composed of two subfactors (numerical and sensory concepts), it was given double representation on the standardization version of the instrument. The items measuring numerical concepts were separated for the convenience of test users from those sampling sensory concepts. (Caldwell and Soule, no date, p.2.)

We administered the test to the NNS children at the end of the school year. Since we do not have pre- and post-test data, our analysis was limited to comparing the sub-groups of NNS children with each other and the norms on the test and correlating the results on this test with the results on other tests; however, we will be able to measure the predictive ability of the test as the study progresses. Table V shows the results on the four factors, the total scores, and their respective percentile ranks. Table VI shows the intercorrelations of the Pre-School Inventory Factor and Total scores and the PPVT post-test raw score for all 1966-67 NNS children

Analysis of Results on the Pre-School Inventory

The results as they appear on Table V are as we would have predicted. (1) There is a consistent pattern of increases in scores

TABLE V

The Mean Raw Sccres and Mean Percentile Scores of the NNS Children on Four Factors of the Pre-School Inventory

Group	N	Factor A		Factor B		Factor C_1		Factor C_2		Total	
		Score	%ile	Score	%ile	Score	%ile	Score	%ile	Score	%ile
NNS-3	22	14.22	45.59	7.27	53.72	7.40	50.54	11.72	60.45	40.63	55.54
NNS 4-1	17	17.17	42.82	9.00	47.23	10.17	57.35	13.88	55.29	49.23	49.29
NNS 4-2	7	19.00	60.00	15.28	82.14	12.28	73.57	16.85	77.85	63.42	80.71
Total	46		46.74		55.65		56.56		61.19		55.54

Factor A — Personal-social Responsiveness
Factor B — Associative Vocabulary
Factor C_1 — Concept Activation, Numerical
Factor C_2 — Concept Activation, Sensory

TABLE VI

Inter-correlations Between the Pre-School Inventory Factors, Pre-School Inventory Total Score and the Post-test Raw Score on the PPVT for the 1966-67 NNS Children

	Pre-School Inventory				
	A	B	C_1	C_2	Total
PPVT	.41	.55	.41	.42	.55
A		.56	.40	.45	.77
B			.40	.51	.80
C_1				.54	.70
C_2					.80

from NNS 3's to NNS 4-1's to NNS 4-2's. (2) The mean percentile scores for the NNS 4-2's are consistently higher than for the NNS 4-1's. (3) The NNS 4-2's scored highest on Factor B - Associate Vocabulary and lowest on Factor A - Personal-social Responsiveness which is consistent with the program emphasis of the New Nursery School. (4) All of the mean percentile scores for the NNS 4-2's are above the norms for the test while the NNS 3's and NNS 4-1's are at or near the 50th percentile. The last observation suggests that our group of deprived children is not significantly different from the norm group and our program has had a positive effect especially on the children who have been in the school for two years.

All of the factors have a fairly high and uniform correlation with the raw scores on the PPVT post-test. One would have expected that Factor B - Associative Vocabulary would have a higher correlation with the PPVT than the other three factors and Table VI reveals this prediction to be accurate.

Our conclusion at this time is that the Pre-school Inventory may prove to be very useful in evaluating the effectiveness of a nursery school program.

The Cincinnati Autonomy Test

The Cincinnati Autonomy Test Battery is being developed at the University of Cincinnati by Thomas J. Banta. The test grew out of a study of the development of children from three to five years of age especially the development of autonomy in thinking, perceiving and social behavior. Autonomy is defined by Banta as "the self-regulating abilities which facilitate effective problem solving behavior. John Holt's description of intelligence, "not how much we know how to do, but how we behave when we don't know what to do" (How Children Fail; 1964) succinctly describes the focus of the Cincinnati Autonomy Test Battery.

The test battery consists of six tests. A brief description of each follows:

1. The Curiosity Box - Attached on the sides and on the top of a box about the size of a small orange crate are all sorts of curiosities - a chain lock, a light switch, a pull chain, a window lock, a bolt, etc. There are also two peep holes and a hole big enough for a child's hand to fit into. The strange, interesting looking thing is placed in front of the child and the examiner says,

invitingly, "This is something for you to play with." For five minutes the child is left in this unstructured situation. The examiner places himself out of the line of vision of the child. The child is scored on his amount of involvement -- manipulatory, tactual, and visual -- and on the amount of verbalization. He receives a point for each type of involvement during a 30 second period. This test measures the way in which a subject explores or does not explore a new complexity within an unstructured situation.

2. Impulse Control - This test is designed to measure a child's impulse control as demonstrated through fine muscle use. The subject is told to draw a line"very fast." Then he is told to draw three lines "very slowly." His score is based on the amount of time he takes to draw an eight inch line very slowly. A ratio of the length of line divided by the time in hundredths of a second is obtained.

3. Incidental Learning - This test compares incidental learning to direct learning. The child is presented ten simple, familiar drawings -- each drawing having one part colored green. The remainder of the drawing is colorless. As each drawing is presented, the child is asked to point to the green area. At the conclusion of the presentation, the subject is asked to recall the drawings, that is, recall that which was seen incidentally. Then the entire series of drawings is presented again and each is named by the subject. After this practice in naming the objects, the child tries to recall the drawings. Two scores are obtained; one is based upon the number of right incidental recalls, and the second is based upon the number of right intentional learning recalls.

4. Response Variability is sometimes known as the Dog and Bone puzzle. A cardboard the size of a chess board is placed in

front of the child. On the board are four block "houses," each standing upright. The houses are arranged about five inches apart in a square. A dog is placed in front of the child and a bone is placed at the other end of the board in front of the examiner. The child is asked to produce as many different routes as possible which the dog can take in order to get to his bone. Each child has ten trails and the scoring is based upon the number of unique ways he finds for the dog to get the bone. He can score one or two points depending upon the complexity of the route, two for routes of greater complexity.

5. Embedded Figures Tests - In this test the child is given a cone-shaped piece of paper and asked to place it over the same shape in a series of pictures of nature, things, people, and geometric drawings. The cone may form a valley between mountains or a part of a cowboy's body or be hidden in a design of circles. The child sees fourteen pictures and one point is scored for each correct response.

6. Replacement Puzzle is a wood-inlay puzzle in which the pieces do not fit together and each piece is a complete object. For example, one piece is in the shape of an airplane and another is in the shape of a horseshoe. Some of the pieces are nailed to the tray; the others are taken out and the child is asked to replace them. The difficulty is that there is only one way in which all the pieces will fit back into the tray. It soon becomes an overwhelming task for the child. After two minutes, a distracting stimulus (blocks) is presented. The subject is told that he can either play with the blocks or finish putting the pieces in the tray. Scoring is based on two factors:

1) Two points are added to the score every 20 seconds that the subject is attending to the task. A negative point is given for inattention during the same time interval. The range of scores is from minus six to plus twelve.

2) The second score is based on the subject's attention to the task when a distracting stimulus is offered. A score of +3 is given for attention to the original task during three twenty-second time periods (one minute). A score of -1 is given for inattention to the task.

The mean scores for the NNS and REN children on the Cincinnati Autonomy Test Battery appear in Table VIII and the intercorrelations on the CATB, the PPVT, and the Pre-School Inventory appear in Table IX.

The REN children as a group scored higher on the Curiosity Box than did the NNS children,but the NNS-3 group scored higher than the NNS 4-1's and about the same as NNS 4-2's. The pattern is the same within the REN group. We can only speculate that children may lose some of their curiosity (or expression of it) from three to four years of age and that the program may have intervened to aid in the retention of curiosity or the feeling of freedom to explore. The number involved is so small that at best this finding only suggests something to watch as the study progresses.

The lower the score on Impulse Control the more control the child exercised in drawing a slow line. The REN children seem to have greater control and within the group the older children do better and the children who have been in the school for the second year do better than the children who are there for the first year. The differences are small and may not prove to be a real difference but

TABLE VIII

The Mean Scores on the Cincinnati Autonomy Test Battery for NNS and REN Children

Curiosity Box	Impulse Control	Incidental Learning Recall	Learning Post-Practice	Response Variability	Embedded Figures	Persistence	Persistence w/distractibility
17.65	.76	.90	2.15	3.25	5.05	7.75	.15
11.86	.63	.93	2.46	4.33	6.20	9.46	1.80
18.00	.57	1.33	4.50	8.33	6.85	11.00	3,00
27.80	.69	.80	2.80	9.00	5.80	5.60	-3.00
21.50	.54	1.08	2.33	8.91	8.58	8.83	-3.00
29.75	.30	1.75	2.75	9.50	10.00	9.00	0

TABLE IX

The Inter-correlations on the Cincinnati Autonomy Sub-Tests, the PPVT, and the Pre-School Inventory Factor and Total Scores for 1966-67 NNS Children

	Cincinnati Autonomy Test Battery							PPVT	Pre-School Inventory				
	2	3	4	5	6	7	8		A	B	C_1	C_2	Total
1	-.21	.28	.17	.01	-.16	-.20	-.29	-.01	-.26	-.08	-.25	-.08	-.18
2		-.11	+.03	+.30	+.21	+.03	+.12	+.38	+.04	+.15	+.35	+.10	+.17
3			.16	-.11	.19	.31	-.04	.00	-.04	.01	-.02	.03	.08
4				.14	.36	.00	.26	.44	.25	.51	.20	.41	.46
5					.23	-.15	.00	.30	..45	.41	..42	.46	.53
6						.21	.11	.23	.13	.22	.48	.44	.40
7							.21	.00	-.06	-.15	-.04	-.02	-.08
8								.17	..41	.01	.05	.23	.20

CATB
1. Curiosity Box
2. Impulse Control
3. Incidental Learning - recall
4. Learning - post practice
5. Respc se Variability
6. Embedded Figures
7. Persistence
8. Persistence with distractability

the pattern is obvious. The same pattern exists in Incidental Learning Recall, Learning After Practice, and Embedded Figures Subtests.

On Response Variability, the dog and bone test, it would appear that there is little or no difference between the three groups of REN children but noticeable difference between NNS 3's and NNS 4's when compared to NNS 4-2's.

The two puzzle subtest scores show a pattern of orderly increase with age and nursery school experience and are the only subtests on which the NNS children scored higher than the REN children. Arbitrarily discounting any correlation between +.15 and -.15, the correlation coefficients, Table IX, show that those two scores have a positive correlation of .21; Persistence has a positive correlation of .31 with Incidental Learning - Recall, and .21 with Embedded Figures; Persistence with Distractability has positive correlations of .26 with Incidental Learning - Post Practice; .41 with Factor A (Personal-Social Responsiveness), .23 with Factor C_2 (Concept Activation-Sensory) and .20 with Total Score on the Pre-School Inventory; .17 with PPVT score; and -.29 with the Curiosity Box Subtest. In other words, Persistence and Persistence with Distractability seem to have a small positive relationship with some of the other variables that purport to be related to school success or cognitive development. However, the fact that the NNS children appear to have scored better than the REN children on these two variables seems to be more than offset by the negative relationships among other subtest scores.

The scores on the Curiosity Box were negatively correlated with Impulse Control (-.21), Embedded Figures, (-.16), Persistence (-.20), Persistence w/ Distractability (-.29), and Factor A (-.26), Factor C (-.25), and the total score (-.18) on the Pre-School Inventory.

There was little or no correlation among the PPVT, Factors B and C on the Pre-School Inventory, and Response Variability of the CATB. The only positive relationships were with Incidental Learning - Recall and Post Practice. Apparently the Curiosity Box is measuring something that (1) is not related to a test of intelligence (PPVT) or innovative behavior (Response Variability), Associative Vocabulary (Factor B) or Language Development (Factor C_2); (2) is negatively related to Persistence, Impulse Control, Social Development, (Factor A) and Concept Activation (C_2) and (3) correlates positively only with Incidental Learning. Furthermore, the middle class children scored higher as a group than the deprived children. We would not have predicted this pattern to emerge but after inspecting the data the only really surprising relationship is the lack of correlation between the scores on the Curiosity Box and the Response Variability Subtests. Certainly this is an area of inquiry that we need to explore in greater depth as this study continues but now we can only be "curious."

Incidental Learning correlates with Persistence (.31), there are probably noteworthy correlations with the Curiosity Box, Incidental Learning - Post Practice, and the Embedded Figures Subtests.

The negligible correlations among Incidental Learning - post practice, Response Variability and Persistence, and the relatively strong correlations among the scores on Incidental Learning - post practice, Response Variability, Persistence, the factors in the Pre-School Inventory points to an area which is presently being analyzed in greater depth. It may be that the combination will account for a high percentage of the variance in the Pre-School Inventory scores.

Results on Concept Formation and Problem Solving Tests

One assumption made about ED children is that their ability to use categories and classification systems is underdeveloped. In order to test this assumption and to measure changes in such behavior, we developed the "C" Test, an individually administered test using the concrete objects listed below:

Stimulus	Response
orange	apple
doll	toy car
cup	bowl
glove	shoe
toothbrush	comb
pencil	comb
lightbulb	crayon
cigarette	cigar
penny	dollar
hammer	screw driver

All the response items are placed on a table in front of the child and named by the tester. Then one stimulus item at a time is held up by the tester who says, "Show me the thing that goes with this orange." If the child names or points to the matched item, he has made a correct response. A pilot test was given to 34 NNS children and to 6 REN children.

As one might expect, we discovered several errors in the construction of the first test. Associations were made which we neither expected nor credited. Many associations were based upon color; the green candle was matched with the green toothbrush or the green crayon and the red apple was matched with the red glove. Based upon these findings, we revised the test to eliminate the possibility of matching by color.

Other associations were made which reflected ability to classify but did not meet the requirements of the test. The doll was matched with the comb because the doll's hair obviously needed combing. In

the revision, we substituted a doll with painted hair for the one with messy hair. We also found that many children did not know what a candle was, so we replaced the candle with a flashlight.

The revised test was administered to all of the NNS and REN children. The results are reported in Table X. Intercorrelations of the "C" Test with the Pre-School Inventory, Factor and Total scores, The Cincinnati Autonomy Test Battery subtest scores, and the PPVT raw scores are given in Table XI.

TABLE X

The Mean Scores and Standard Deviations for NNS and REN Children on the "C" Test.

Group	N	Mean	SD
NNS 3	20	1.7	1.65
NNS 4-1	16	3.3	2.43
NNS 4-2	6	6.2	1.66
REN 3	7	3.7	2.60
REN 4-1	7	4.7	1.03
REN 4-2	3	5.0	1.41

TABLE XI

Correlations of "C" Test with Other Tests - N=29 Groups 1-3

	Pre-School Inventory					Cincinnati Autonomy Test Battery								PPVT
	A	B	C_1	C_2	Total	1	2	3	4	5	6	7	8	
C test	.41	.72	.40	.37	.60	-.01	-.26	.14	.27	.41	.15	.05	.01	.47

The pattern of the scores on the "C" test is the same as we have observed before. The REN children as a group have higher scores than the NNS children and the scores improve within each group from three year old children to four year old children who are in their second year.

The correlations of the "C" test with the Pre-School Inventory and the PPVT are unbelieveably high, and we will need to do more extensive testing with the "C" test to determine its reliability before accepting the data in Table XI at face value. If the correlations persist, we will have a very simple, easily administered test that requires no verbal response, can be easily translated into other languages and can be used in a test battery for three and four-year-old deprived children. The "C" test also correlates with Response Variability (.41) and either there is a negative or no correlation with Impulse Control. Since Impulse Control correlated positively with the PPVT (.38), they may be accounting for different aspects of the PPVT and Pre-School Inventory.

Children's Categories Test

This test is a measure of a child's ability to discriminate among

abstract concepts such as the largest circle from among several circles. The test uses a set of colored slides that are projected one at a time onto a rear-vision screen about the size of a 14-inch TV screen. The child can indicate his response by pulling one of four levers which are color coded (red, blue, yellow, and green). The child matches the color of the lever with the color of his chosen response. For example, if the concept to be discriminated is "the largest circle" and that circle is colored red, the child will be correct if he pulls the red lever. In that event he hears a bell. There is no sound (i.e. auditory feed-back) for a wrong response. The only data the child receives are the results of his previous selection:thus problem-solving processes such as elimination of wrong previous approaches are involved. The first slide shows a red triangle and the task is to match color alone. The next nine slides are simply color matching. The next ten slides deal with the problem of two-of-a-kind; one slide shows two green circles, a yellow circle and a blue circle. On the next series of ten slides the problem is to discriminate the largest shape. This is followed by a series which presents several of the same shapes with one different shape, such as a triangle among several different or same-sized squares. The next series of ten deal with incomplete parts. For example, the child sees a square or circle divided into four colored quarters but one quarter is incomplete. See the following examples in which the upper right quadrant represents the incomplete one:

On the next ten slides a quadrant of the square or circle is missing and the task is to identify the missing part, so the correct response is

to pull the lever for the color not seen on the screen. The final ten slides are sample reviews of the previous series and are designed to test for short-term memory. In scoring the test, the child receives a score on the first ten items (color), the next ten (two of a kind), the ten largest, the next 20 (partial or missing parts), the last ten, and a total score. The test was originally developed by Halstead to test biological intelligence in children.

We first administered the test to 39 NNS and 17 REN children in September and October of 1966. For the post-testing in May, 1967, we eliminated 20 slides on the basis of an item analysis in order to shorten the test and eliminate non-discriminating items. The results on the post-test are reported in Table XII.

Analysis of Results on Children's Categories Test

The first observed difference in Table XII is that the rather consistent pattern we have noted before on other measures is not evident. In some instances, the 4-1's perform better than the 4-2's. There are some apparent differences in scores with the REN group obtaining a high average score but whether or not these differences are significant is open to question until a more adequate analysis is made. Once again, the correlations with the Pre-School Inventory are fairly high and the Categories Test correlates with Incidental Learning - post-practice (.48), Response Variability (.37), and the Embedded Figure test (.37). Since this test seems to be relatively free from a reliance upon previous learning and does correlate with the items mentioned above, it also appears to warrant continued study and development.

TABLE XII

The Mean Scores for NNS and REN Children on the Children's Categories Test

Groups	N	Color		Most-Largest		Different		Partial or Missing		Review		Total	SD
		M	SD	M	SD	M	SD						
NNS-3	19	5.21	2.85	4.26	2.04	2.78	2.14	5.84	2.25	3.31	1.17	1.26	6.47
NNS 4-1	14	6.85	2.28	5.00	1.81	4.86	1.92	6.00	4.07	3.21	1.74	25.64	8.35
NNS 4-2	6	7.50	1.70	4.00	0.81	4.16	2.33	5.50	2.75	3.83	1.06	25.66	4.66
REN 3	4	7.25	12.25	3.00	1.22	3.50	1.12	4.25	1.47	4.50	1.12	22.25	7.25
REN 4-1	10	8.20	1.77	6.00	3.06	7.20	2.92	12.70	7.46	6.50	1.32	40.80	15.80
REN 4-2	3	8.66	.47	4.00	2.45	5.66	1.70	10.66	5.23	5.00	.81	34.00	2.83

TABLE XIII

Correlations Among Total Scores on the Children's Categories Test and Scores on Other Tests Administered During 1966-67 to NNS and REN Children

	Pre-School Inventory					Cincinnati Autonomy Test Battery								PPVT
	A	B	C_1	C_2	Total	1	2	3	4	5	6	7	8	
Childrens Categories Test	.29	.37	.34	.58	.56	.07	-.17	.16	.48	.37	.37	-.05	-.08	.23

The Test of a Young Child's Ability to Name the Colors

We have developed an achievement test designed to measure a child's ability to name the basic colors. This test utilizes the Language Master, but it can be administered nearly as well without such special equipment. The colors of black, white, red, orange, yellow, brown, green, purple, and blue are painted on nine different Language Master cards, one color on each card. The name of the color is recorded on the instructor's channel, "The color of paint on this card is blue."

The tester presents one card at a time and asks, "What color is the paint on this card?" The teacher waits for three to five seconds for a response. If the child does not respond or gives a wrong answer, we assume that he cannot name that color. In any event, the tester lets the child run the card through the machine to hear the correct answer. (If the Language Master is not used, the tester tells the child the correct answer.)

After all nine colors have been presented, four cards are presented to the child simultaneously. Three cards contain colors which the child knows, the fourth card being one which he did not know. The tester says, "Point to the green (i.e., the unknown color) colored

paint spot." Thus the child has a chance to discover the name of a color by the process of elimination. This second procedure can be used as a test of a child's ability to arrive at a correct response by eliminating wrong responses.

TABLE XIV

The Mean Pre- and Post-Test Scores and Mean Change for the NNS and REN Children on the Test of a Young Child's Ability to Name the Colors.

Group	N	Pre-Test	Post-Test	Mean Change
NNS 3	15	2.0	5.2	3.2**
NNS 4-1	11	1.45	6.63	5.18**
NNS 4-2	5	7.8	9.0	1.2*
REN 3	6	4.5	7.8	3.3*
REN 4-1	10	6.4	8.0	1.6*
REN 4-2	4	7.3	8.3	1.0

**Significant at .01 level (test dependent samples)
* Significant at .05 level